Name _____ Date _____ Period _____

What Does it *Mean*?

Scenario

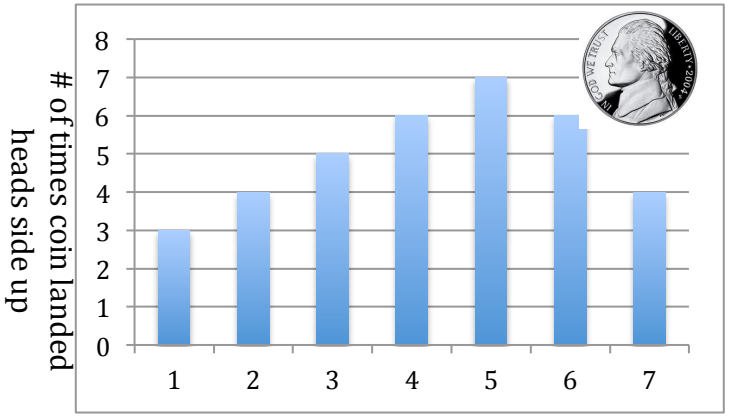
Traci flipped a coin 10 times and recorded the number of times the coin landed heads side up. She then repeated this 6 more times and recorded the data in the bar graph below.

Traci wants to find the average or *mean* number of times the coin landed heads side up.

Traci's friend Matt asked her *about* how many times she got heads from each of the 10 flips.

What number would you pick to answer about how many times the coin landed heads side up?

_____



When you try to find a number that represents the data best as a number in the "middle", we call this a ***measure of central tendency***. The typical measures of central tendency *are* ***mean, median*** and ***mode***.

Today we are going to look at the mean *or* average number of times the coin landed heads side up.

1) Take the blocks your teacher gave you and build towers to represent each column in Traci's bar graph.

2) Redistribute the blocks so that each column has the same number of blocks. Draw what your columns look like after redistributing in the table below.

1	2	3	4	5	6	7

3) There are now _____ blocks in each column.

4) The number _____ is the average or ***mean*** number of times heads landed up when Traci was flipping the coin, per event.

For Review: What should Traci's results be based upon theoretical probability? _____ out of 10 flips should have landed heads side up.

How do we find the *mean* of a set of data?

Let's try this a couple of more times with the blocks, looking for a pattern. Your teacher will tell you which set to work with, starting with the following numbers of blocks per column.

Set 1: 3, 4, 5, 6, 4, 4, 2	Set 2: 1, 3, 3, 5, 4, 2
Set 3: 7, 4, 2, 4, 3	Set 4: 5, 5, 4, 4, 7

a) Find the ***mean*** by redistributing the blocks so that each column has a *fair share*. How many blocks are in each column?

b) Be ready to share the total number of blocks and your ***mean*** with the class.

5) Looking at the data recorded on the board, what relationship(s) do you see between the sum of each set of data and the ***mean***?

Let's test this ***conjecture*** by trying it out with Traci's data.
6) a) Add up the total amount of times that the coin landed heads side up for all 7 events.

Total = _____

b) Look at the ***mean*** of the data (your answer from #4). What is the relationship between the total and the ***mean***?

c) Did the conjecture hold true (did you see the same pattern occur)? Explain.

7) Describe how you would find the ***mean*** of a data set.

_____

_____.

8) What does the ***mean*** tell us about set of data?

_____

_____.

Mean Absolute Deviation

So the mean of the data was 5. Was she close to this number every time? How can we measure how *close* each trial was to the mean of 5?

Mean Absolute Deviation is when we find the distance of each value from the ***mean***. This helps us describe a type of ***variability*** within a set of data.

For Traci's data, we found the ***mean*** to be 5. We can use a number line ***or*** a table to help us find the ***mean absolute deviation***.

Number Line to Find MAD
Find the distance of each value from the mean.

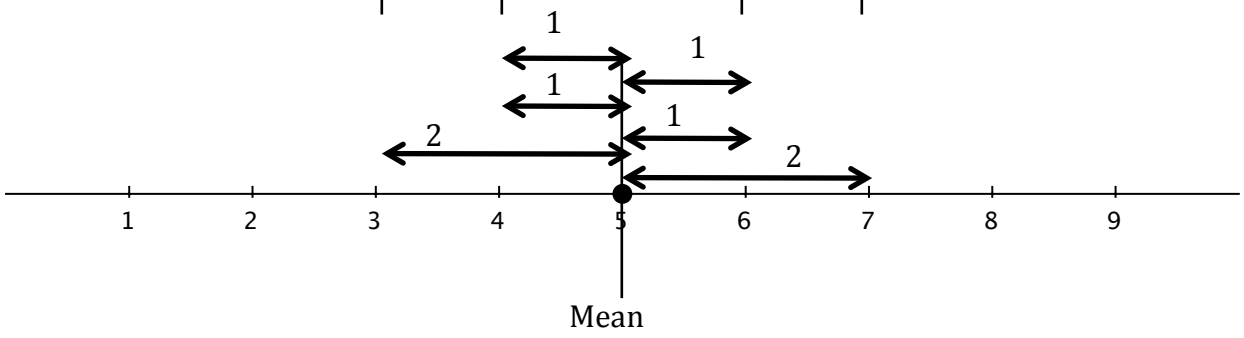


Table to Find MAD

Value	Distance from 5
3	2
4	1
5	0
6	1
7	2
6	1
4	1

Find the mean of those distances!

mean absolute deviation = $\frac{2+1+1+0+1+1+2}{7} = 1.14$

What does the MAD value of 1.4 mean in terms of the variability of Traci's results?

Practice

Get into groups of 6 students and record the data from the following sets of survey questions about your group and then find a) the ***mean*** of each set of data as well as b) the ***mean absolute deviation*** by using a table or number line. If your group does not have 6 students, randomly select a number between 1 and 15 to fill in the missing numbers. If you have a smartphone, you can go to *random.org* to have a number randomly generated.

1) The number of pets each student in the group has. _____, _____, _____, _____, _____, _____

The *mean* number of pets for our group is _____.

The mean absolute deviation is _____.

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2) The number of cousins each student in the group has. _____, _____, _____, _____, _____, _____

The *mean* number of cousins for our group is _____.

The mean absolute deviation is _____.

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3) The number of pairs of shoes each student in the group has. ____, ____, ____, _____, _____, _____

The *mean* number of pairs of shoes for our group is _____.

The mean absolute deviation is _____.

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4) The number of writing utensils (pens, pencils, markers, etc.) each student in the group has in their backpack, or with them. _____, _____, _____, _____, _____, _____

The *mean* number of writing utensils for our group is _____.

The mean absolute deviation is _____.

Teacher Directions: What Does it *Mean*?

Materials:

- 1" cubes (about 35 per student or pair of students)
- Copies of What Does it *Mean*? (1 per student)

Part 1: Developing a Conjecture about ***Mean***

- Have a student volunteer read the scenario and then have a class discussion about the type of experiment that was performed.
    - Traci flipped a coin 10 times, but knowing from the prior unit on probability that the more times an experiment was performed the outcomes would get closer to the theoretical probability, she performed the experiment 6 more times.
- Pass out the blocks to students, and model building the columns from the graph provided. Instruct students to build the columns and to answer questions 2- 4. Once students are finished, have them compare their results with an elbow partner.
- Students should have 5 blocks in each column.
- Have a class discussion about what students think the "mean" means and how distributing the columns into "fair shares" demonstrated finding the mean by use of manipulatives. (Conceptually)

Part 2: Testing the Conjecture about ***Mean*** and Defining the Procedure

- Tell students that we are going to look for a pattern to come up with a rule for finding the ***mean*** of a set of data by splitting up the class and looking at 4 sets of data. They will need to use the blocks, and redistribute them into equal columns to find the ***mean*** of their data set.
- Have different groups of students work on each of the data sets, 1, 2, 3, or 4. Once students have found the ***mean*** using their blocks select a student to come to the board and record the sum of the data and their ***mean*** into the appropriate row and column.
    - Data chart on the board should look like this:

Set #	Sum	Mean
Set 1: 3, 4, 5, 6, 4, 4, 2		
Set 2: 1, 3, 3, 5, 4, 2		
Set 3: 7, 4, 2, 4, 3		
Set 4: 5, 5, 4, 4, 7		

- Once you have the data have students answer question #5. After two-minutes, have them compare their answer with an elbow partner. Randomly select pairs to share what relationship they see between the sum of each data set and the ***mean***. Students should come to the conclusion that the ***mean*** can be found by dividing the sum of the numbers by the number of numbers in the data set (sample space). (You may need to frame questions to get students to see this relationship.) Explain the

word ***conjecture***: A conjecture is a statement that is believed to be true but is not yet proved.

- Tell the students that we are going to try out our conjecture one more time with Traci's data. Have students complete #6, and then share their results with the class.
- Discuss as a class, the procedure for finding the ***mean*** and have them complete questions 7 and 8.

Part 3: Mean Absolute Deviation

In this part of the lesson students will learn about a ***measure of variability***, ***mean absolute deviation*** **(MAD)**. Students will further their understanding of this measure of variability in terms of variance in high school. MAD can be defined as the average distance of each data value is from the mean. The MAD is a gauge of "on average" how different the data values are from the mean value.

- Have a student volunteer read the first two statements about *mean absolute deviation* (MAD).
- Go through the two examples with students on how to find MAD, by either using a number line to find absolute distance between each value in the data set to the mean or the table. (Note: one of the values of the data set was 5, which has an absolute value of 0 on the number line, which is why only 6 of the 7 experiment results are shown.)
- Have students look at the procedure for finding the MAD. Ask students if this procedure for finding mean is the same as they discovered early. (Yes!)
- Direct students to answer the final question on the page with a partner. Once most pairs have something recorded, ask for volunteers to share their responses. This is the average between each data value. 1.4 is relatively small, which means that Traci's results were close to the mean value.

Part 4: Practice

- Put students into groups of 6 and have them complete problems 1 – 4. Answers will vary depending upon the data sets for each group. Walk around and monitor students.
    - If there is a group that does not have 6 members, tell them to randomly select a number between 0 and 15 for each problem to fill in the remaining blanks. They will choose a new number for each blank they have to fill in.